TESTS ON RELATIVE STRENGTH INDEX TRADING RULES IN CHINA STOCK MARKET

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ABSTRACT

The relative strength index (RSI) has endured far longer than most other technical indicators. Unfortunately, durability does not necessarily equate to profitability. Thus the prime objective is to verify the profitability of RSI.

RSI levels are between zero and one hundred. The higher the RSI, the more the market is considered overbought and is expected to retreat downward. The lower the RSI, the more the market is considered oversold and should reverse to the upside. Based on these principles, we designed the tests on profitability to embrace following trading rules.

1. RSI levels over 70 are considered overbought and hence sell signals.
2. RSI levels under 30 are considered oversold and hence buy signals.
3. A buy decision is considered successful if the stock price rises the next day. A sell trade is considered successful if the stock price drops one day after the sell signal.
4. Abnormal returns are calculated and hypothesis testing is performed to draw conclusion on the significance of positive (and negative) abnormal returns.
5. All A-shares and B-shares in the China's equity market are covered and the testing period is limited to 3 years from January 1, 1999 to December 31, 2001.

The results are heuristic: For A-share markets, buy signals cannot help beating the market. Sell signals do generate abnormal returns. For B-share markets, buy signals work but sell signals result in significant negative abnormal returns. Higher abnormal returns in B-share markets for buy signals are probably due to the announcement of deregulation of the B-share markets in February 2001. This impact of relaxation of trading restriction is proved to be true by additional tests on the abnormal returns for the period before and the period after February 1, 2001. The big difference in the abnormal returns between these two periods hints the importance of the role played by change in investing environment on technical trading profits. Finally, we tried to find out other factors that can enhance our trading model. "Market value" and "volume turnover" are chosen for hypothesis testing on their correlations with abnormal return. Although no significant correlation can be found, there is still much room for further studies on this topic.

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CHAPTER I

INTRODUCTION

Of the two approaches that are usually used to seek profits from trading stocks, more and more investment analysts prefer technical analysis to fundamental analysis. Despite the criticism on lacking theoretical support by the academics, the popularity of technical analysis can be attributed to its simplicity in application. For example, technical analysts solely need to study price charts without detailed analysis of financial statements and many other non-quantifiable factors (e.g. investors' attitude towards the industry, employee training and loyalty, etc) which carry impact on stock price movements. Regardless of which approaches are deployed, it is proven by many empirical researches that they work well only when the efficient market hypothesis (EMH) of capital market does not hold. Therefore, it would not be surprising to find profitable to use technical analysis in some emerging capital markets which are usually less informationally efficient. China's equity market, which is characterized by shallow investor base of retail type and stringent restrictions on stock ownership, would be a potential candidate for verifying the lucrative assertion of technical

analysis. Relative strength index of technical analysis is chosen as a testing tool.

Technical Analysis

Technical analysis is essentially the search for recurrent and predictable patterns in stock prices. According to Murphy (1999)[1], there are three premises on which the technical approach is based:

1. Market action discounts everything.
2. Prices move in trends.
3. History repeats itself.

The second and third premises explain the possibility and need to search for recognizable patterns but the first premise is similar to EMH that stock price fully reflects all the currently information about that security. The difference here lies in the timeliness. Efficient capital market assumes any new information that can possibly affect price – fundamentally, politically, psychologically, or otherwise – is instantly reflected in the price. But the technical analysts, though affirm the significance of information regarding future economic prospect of a firm on stock price, believe that analyzing the impact of such information on firm's value is not necessary for a successfully trading strategy. This is because whatever the fundamental reasons for a

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[1] Murphy, John J. Technical Analysis of the Financial Markets. 1st ed. NJ: New York Institute of Finance, 1999, pp. 2-5.

change in stock price, if the stock price responds slowly enough, the analysts will be able to identify a trend that can be exploited during the adjustment period. The key to successful technical analysis is a sluggish response of stock price to fundamental supply and demand factors. This is diametrically opposed to the notion of an efficient market.

The Characteristics and Efficiency of China's Equity Markets

As timely responses of stock prices to reflect current market information are crucial to the validity of technical analysis, the market efficiency should be discreetly considered. An efficient capital market implies that the current security prices have fully reflected all available information. Fama (1970) determines three sufficient conditions: [2]

1. All agree on the implications of the information for the current prices and distributions of future prices of each security
2. No transaction costs in trading securities
3. All available information is costlessly available to all market participants

We will discuss each of the above in regard to China's equity markets in an attempt to shed light on some major market characteristics and then draw a

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[2] Fama, Eugene F. "Efficient Capital Markets: A Review of Theory and Empirical Work." Journal of Finance, May 1970, pp. 6-7.

preliminary implication on the efficiency.

Market Participants

The first assumption is affected by the diversity of market participants in terms of investment objectives and constraints (e.g. return objectives, risk tolerance, investing horizon, experiences and skills, etc). The smaller the diversity, the more rapidly the market participants reach an agreement on and reflect the implication of information on current prices. In China, the equity markets are dominated by a large number of retail investors with similar objectives (e.g. seeking for short-term profits) and constraints (e.g. low risk tolerance, limited investing experiences and immature analytical skills, etc).

Despite the government effort to encourage market participation by both domestic and foreign institutional investors (Appendix 1), 99.6 percent of the share account holders are retail investors at the end of 1999 (Appendix 2). There are many reasons for this situation. The fundamental one rests on the poor qualities of companies listed, which worry the institutional investors more since they tend to invest long term. More than 90 percent of listed companies are state-owned enterprises (SOEs) which are usually not efficient users of capital. Money raised from IPO by these SOEs may be used for paying workers' wages, taxes and pension

schemes. Aggravated these problems are serious corruption, insider dealing and severe moral hazard caused by inadequate financial disclosure. Being further discouraged by government regulations on currency inconvertibility and restrictions on the purchase of A-shares which represent 98 percent of China's listed share issues to Chinese nationals[3], foreign institutional investors prefer making their China plays via Hong Kong listed H-shares or red chips in what are generally perceived as higher-quality mainland companies.

The result is the strictly state-regulated capital markets filled with numerous but similar retail investors who are highly sensitive to local news and government regulations[4]. Extreme market volatility and speculative activities seeking for short-term profits are more pronounced in China than in other emerging markets. Also, because of apathy of foreign investors in making investments in B-shares markets, B-shares are often traded at a quarter of the values of their A-share counterparts.

Transaction Costs and Tradability of Shares

Frictionless capital markets with zero transaction cost seldom happen in reality.

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[3] However, in an effort to increase the depth and liquidity of the market, in October 1999, licensed foreign insurers were granted the right to invest in A-share mutual funds.

[4] Howie and Walter (2001) said that, "the [China's capital] market's character reflects the influence of two factors: (1) investor sentiment about the country's overall economic performance; and (2) government policy (p. 166).

This is particularly true in China where the capital markets are imbued with spirit of state planning, state control and state interest.

The transaction costs in China are still high compared with those of Hong Kong[5]. Trading barriers in stocks mainly come from interventions of the Chinese government via legal regulations. Among all, the state-owned spirit remains the most unique (contradictory also) feature in the transfer of stock ownership system. It is best illustrated by Article 4 of China's 1994 Company Law that the ownership rights to the company [limited by shares] belong to the State but not the shareholders. Therefore, to reinforce the government's control on listed companies, the Standard Opinion[6] defines the types of shares into state shares, legal person shares, internal staff shares, individual shares and foreign shares. Each type of share has different regulations governing the right of ownership transfer. Tradable shares only accounts for about 30 percent to 35 percent of the market capitalization. The remaining 65 percent to 70 percent is mainly represented by non-tradable legal person shares and state shares (Appendix 3). The State, either directly or indirectly, through the holding of these non-tradable shares that its control over the listed companies can be maintained. Another example can be seen from the introduction by the government of

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[5] For example, as of November 16th 2001, commission and stamp duty, the two major user charges, are 0.35 percent and 0.3 percent of transaction value for A-shares and 0.55 percent and 0.2 percent for B-shares in China; while those costs in Hong Kong are only 0.25 percent and 0.1 percent of transaction amount

[6] The Standard Opinion and supporting legislation, drafted in 1989 and implemented in 1992, was

control on stock price bands of ±10 percent from December 16, 1996 when facing overheating of stock markets.

These state-controlled but publicly listed enterprises detract the benefits of public ownership of stock and place a significant drag on the reform of the corporate management.

Availability of Information

Since the operation of invisible seat system was put into trading operation in 1995 for Shenzhen Stock Exchange and 1997 for Shanghai Stock Exchange, satellite links have been set up between the exchange mainframe trading system and brokers' offices across the country to facilitate instant trading and receive price and volume information for all securities on a real time basis. The information received is usually reconfigured by software applications into a more user-friendly format. One such system is Qianlong which provides a graphic for each stock and the bid/offer price and size for each security. The software also provides historical data and a variety of technical analyses. Other software packages include Huijin and JianGong. Most trading halls have at least two software packages for investors to analyze exchange data. In addition, there is a huge range of television programs, newspapers, magazines,

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aimed at 'standardizing' the helter-skelter approaches of the 1980s to creating shareholding companies.

and books discussing the market. In short, obtaining market information is not a problem in China.

However, non-market public information like financial statement disclosures is far from satisfactory from the angles of quantity and accuracy. The most likely results are severe moral hazard problem and insider trading. Better corporate governance and more independent auditing with recognized professional standard are urgently needed especially after China's entrance into WTO.

Implication on Weak Form Market Efficiency

As technical analysts attempt to predict future prices based on the patterns of past price movements, the chance of being profited by using technical tools depends on whether weak form efficiency holds. Weak form EMH assumes that current stock prices fully reflect all securities-market information, including historical sequence of stock price, rate of returns, trading volume and other market-generated information. In other words, by the time the market information is public, the price adjustment has taken place. Therefore, a purchase or sale using a technical trading rule that uses historical market information should not generate abnormal returns after considering risk and transaction cost. Our task here is to analyze how the aforementioned market conditions affect the efficiency and effectiveness of stock prices responsiveness to

securities-market information. Other issues like adequacy of financial disclosures and insider trading will not be discussed in this study.

First, China's capital markets are dominated by a large group of similar retail investors. Their similarities in investing background accelerate the process to reach a consensus among the market participants. This phenomenon increases the speed for their interpretations of market information to be felt on stock prices and enables the impact to be more effectively reflected. Moreover, volatility per se is in no way inconsistent with efficiency[7]. A stock in an efficient market should adjust to new information by changing price. In truth, the absence of price movements in such frequently changing capital markets as the ones in China might suggest inefficiency.

Second, the existence of transaction costs and barriers as well as volatility limit on stock prices would be expected to have negative effect on market efficiency since they inhibit the flow of transaction. However, one of the findings by Li and Li (2000)[8] stresses that government interventions (i.e. $\pm$ 10 percent limit on price fluctuation) do not have a significant impact on the existing level of efficiency. It suggests that improving market efficiency is more affected by long run task contingent on improvements in infrastructure and has little to do with temporary measures taken by

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[7] Ross, Stephen A., Westerfield, Randolph. W. and Jaffe, J. Corporate Finance. 5th ed. Singapore: McGraw-Hill, 1999, p. 325.

[8] Li, Xiaoming, and Li, Wei. "An Empirical Study on Evolving Market Efficiency for China's Stock Markets." Working Paper Series No. 0016, Massey University, Auckland, 2000.

government for short-run stabilization purposes.

Third, the easy access to market information and instant trading facilitated through satellite link enhance the speed at which new information be reflected in stock prices.

But even if transaction costs, information that is not freely available to investors and disagreement among investors about implications of given information were to exist in China's capital markets, they would not necessarily be the sources of market inefficiency but the potential sources only. In fact, all three occur to some extent in every market. Measurement of their effects on the process on price formation, is of course, one of the goals of our research. Equivalently saying, if we can consistently and statistically achieve significant abnormal return by using relative strength index in trading stocks, we can conclude that the China's capital markets are not weak form efficient.

Relative Strength Index

Relative Strength Index (RSI) is an oscillator first introduced by J. Welles Wilder, Jr. in the June 1978 issue of Commodities (now known as Futures) magazine, later in his book New Concepts in Technical Trading. RSI measures the strength of any trading vehicle by monitoring changes in its closing prices. It is a leading or a

coincident indicator.

$$RS = \frac{\text{Average of x days' up closes for a selected number of days}}{\text{Average of x days' down closes for a same number of days}}$$

$$RSI = 100 - \frac{100}{1 + RS}$$

RSI is plotted on a vertical scale of 0 to 100. Usually, movement above 70 is considered overbought and a sell order should be placed, while a move below 30 is oversold and one should buy the stock. The RSI's objective is to measure the relative strength of a trend for use in forecasting its possible continuation or reversal. The concept of RSI is based on the assumption that after a strong rally the overbought market will enter into a downward correction phase. The opposite holds true as well. After a strong fall, RSI will give an oversold index; presumably this presages a rally. RSI tries to measure the extent of these overbought and oversold conditions in order to identify when the correction phase is likely to begin.

CHAPTER II

LITERATURE REVIEW

Limited literature has been researched on testing the profitability of RSI in the China's stock markets. However, separate studies on technical analysis in both mature and emerging markets, China's stock market efficiency, and profitability of stock trading based on RSI in the U.S. equity markets, are abounding.

Abundant researches have been conducted in the U.S. equity markets using stock prices or other market data like odd-lot figures, advance-decline ratios, short sales, short position, and specialist activities[9]. Most of the studies suggested that these trading rules generally would not outperform a buy-and- hold policy on a risk-adjusted basis after taking account of commissions. Hence, the results support the weak form of the EMH. For the similar studies on emerging markets. Ratner and Leal (1998)[10] applies 10 Variable Length Moving Average (VMA) models to test the effectiveness of technical trading in 10 large emerging equity markets in Asia and

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[9] Reilly, Frank K., and Brown, Keith C. Investment Analysis and Portfolio Management 6th ed. Fort Worth: Dryden Press, 2000, p. 219.

[10] Ratner, Mitchell and Leal, Ricardo. "Emerging Equity Markets of Latin America and Asia." Research Paper, Rider University, Lawrenceville, NJ, 1998.

Latin America: Argentina, Brazil, Chile, Mexico, India, Korea, Malaysia, Philippines, Taiwan, and Thailand. Daily inflation adjusted returns for the January 1982 to April 1995 period are utilized. The findings indicate that VMA trading models do not possess widespread ability to profitably forecast future stock price movements in most of the emerging markets of this study.

Results of studies on China's stock market efficiency are mixed. Liu, Song, and Romilly (1997)[11] follow the random walk approach in testing the efficient markets hypothesis using daily closing prices from the Shanghai and Shenzhen Stock Exchanges between 21 May 1992 and 18 December 1995. The findings indicate that the two stock markets are efficient. Another study (Long, Payne, and Feng,1999) [12] examines market efficiency and the price-volume relation for the Shanghai Stock Exchange. One of its results is again that both A- and B-shares follow a random walk (with drift), thus supporting EMH for Shanghai. Nevertheless, the main findings of recent research by Li and Li (2000) are contrary to previous works that the Chinese stock markets are not yet efficient informationally. Also, the government interventions in the form of imposing an upper and lower bound on the changes of the stock price do not seem to have had adverse effects on market efficiency, but seem to have been

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[11] Liu, X., Song, Haiyan and Romilly, Peter. "Are Chinese Stock markets Efficient? A Cointergration and Causality Analysis." Applied Economics Letters, 4 (1997): 511-515.

[12] Feng, Chenyang, Long, Michael. D. and Payne, Janet D. "Information Transmission in the Shanghai Equity market." Journal of Financial Research, 22 (1999): 29-45.

conductive to maintaining market stability.

Finally, many studies on RSI conclude that stock trading based on RSI is unable to beat the market. Meissner (2001)[13] carried out a large-scale study on 30 stocks of the Dow Jones Industrial Average for a 10-year period from August 1989 to August 1999. RSI periods from 2 to 30 days have been tested. In addition, RSI signal levels from 5 to 50 for buy signals and from 50 to 95 for sell signals were analyzed in five unit increments. The results of the RSI indicator were surprisingly unprofitable.

From the above previous researches, we can infer that the implication for technical analysis is quite grim. No technical trading rules like moving average or RSI can generate significant profit in most mature and emerging equity markets. On the other hands, discussions on China's market efficiency are inconclusive. There is room for further research and hence potential for profitable technical trading provided that you can choose a "right" trading rule.

[13] Meissner, Gunter, "RSI Revisited." Research paper, Oster Communications, 2001.

CHAPTER III

METHODOLOGY

Primary Research

Three types of hypothesis testing have been performed. The first type is used to test the abnormal returns derived from trading stock based on RSI levels to verify the profitability. The second type is attempted to assess the impact of the deregulation of B-share markets on the trading results. The third type is to test the correlation between abnormal return and other market data like market value and turnover volume. Strong correlation implies that incorporating those factors could enhance the trading model.

Source of Data

The sample covers every A-share and B-share in both Shanghai and Shenzhen Stock Exchanges. Daily closing prices adjusted for dividends and stock splits for 1,249 stocks (Appendix 4) were obtained from Datastream over the 3-year period from January 1, 1999 to December 31, 2001 (i.e. 782 trading days). Therefore, the study has used 976,718 closing prices to verify each chosen period RSI.

Four RSI periods (5, 9, 12, 14 days) are chosen for investigation. Shorter RSI periods result in a more volatile RSI and consequently more buy and sell signals. RSI for each stock in the whole 3-year period is calculated every day using the formula stated before. Only one trading decision (i.e. buy, sell or hold) is made for each stock each day based on the level of RSI.

Spreadsheet Calculation Procedure

We employ spreadsheet to find out the average daily abnormal return resulted from all trading decisions based on RSI in the 3-year period for each A-share and B-share in the Shanghai and Shenzhen equity markets.

We first define the trading rules which are set at the RSIs of 30 and 70 respectively. A buy decision is made when RSI is less than 30, and a sell order is placed with RSI more than 70. In cases of RSI between 30 and 70, no trading decision will be required for that day. Daily return for each trading decision is computed and compared to daily market return. The difference is the daily abnormal return for that trading decision.

Daily trading return (TR) and market return (MR) are computed using the following equations:

$$TRj,t = \frac{Pj,t+1 - Pj,t}{Pj,t}$$

$$MRs,t = \frac{MIs,t+1 - MIs,t}{MIs,t}$$

Where $P_{j,t}$ is the closing stock price for stock j on day t, $MI_{s,t}$ is the closing index of stock market s for the type of stocks which $P_{j,t}$ belongs. Hence, relevant abnormal return (AR) for stock j on day t is:

$$AR_{j,t} = TR_{j,t} - MR_{s,t}$$

Two things are worth noting: 1) The above calculations are required only when the daily RSI is either > 70 or < 30. In other words, there are more likely that TR, MR and AR will not be computed for each trading day; 2) The sign of return for successful buy decision is different from that of sell decision.

A buy decision is considered successful if the stock price increases one day after the buy signal (i.e. RSI <30). Conversely, a sell trade is considered successful if the stock price decreases one day after the sell signal (i.e. RSI >70). We can expect, from the above formulas that a successful buy trade will yield positive abnormal return but the abnormal return will be negative if a sell trade is successful. In our study, we have added a minus sign in the spreadsheet formulas for sell trades' return calculations such that successful trades, whether follow buy or sell signals, will always give positive trading returns. One-day period is picked due to the short-term investing nature in China's stock markets. The outcome is the daily abnormal return

for each buy or sell trade, which may be positive, negative or zero. The unit is in percentage.

The average daily abnormal returns for sell trades and buy trades are then determined separately. For example, the average daily abnormal return for sell (buy) trades is calculated by dividing the sum of daily abnormal returns resulted from all sell (buy) trades that happened in the past 3 years by the total number of sell (buy) trades within period. That means each stock has two average daily abnormal returns (one from buy signals and one from sell signals), which are the observations for the hypothesis testing. Finally, the process is repeated four times for four different periods of RSI for each stock.

Since these average daily abnormal returns can be positive, negative or zero, a hypothesis testing is essential if we want to draw a conclusion on the profitability of using RSI as a trading rule. As the population variance is not known, t-test is usually applied.

Hypothesis Testing

The First Type of Tests

The first type is to test the abnormal returns obtained by following RSI trading rules. Let μ be the hypothesized sample mean of abnormal return derived from trading

stocks for 3-year period using n-day RSI which is set at 0. The null and alternative hypotheses are as follows:

$$H_0: \mu = 0$$

$$H_1: \mu \neq 0$$

A two-tailed t-test with a 5 percent level of significance (i.e. alpha) is applied here. If the null hypothesis is rejected, we can conclude that using RSI trading rules in the three years could either beat the market or perform worse than market. The tests for buy signals (buy-and-then-sell rule) are carried out separately from those for sell signals (sell-and-then-buy rule).

The Second Type of Tests

As previously mentioned, the Chinese Government has been enforcing a series of measures to extend the investor base. One of the most important steps was to allow local people investing in B-share markets. This deregulation was taken on February 19, 2001. Since relaxation of restrictions may attract more investors and hence improve market efficiency, the second type of tests is aimed at estimating the impact on RSI trading result. This can easily be done by repeating the above tests twice, each with different time frames. One test was done for the period from January 1, 1999 to January 31, 2001 and another is done for the period from February 1, 2001 to

December 31, 2001. Any significant differences in the t-statistics between two time frames could be attributed to the consequences of deregulation. Only B-share markets were tested.

The Third Type of Tests

Trading stocks based solely on RSI levels are rather simple. There might exist other factors or indicators that could help to attain better results if they were considered in trading stocks using RSI. We chose volume turnover and market value as the potential candidates, partly because they are already available from the Datastream. The hypothesis testing required is:

H_0: Pearson Correlation = 0

H_1: Pearson Correlation $\neq$ 0

It is a series of tests on the correlation between the average abnormal return and volume turnover (or market value of the relevant company) for each stock in A-share markets. Should the p-values be smaller than alpha (0.05), we can reject the null hypothesis and conclude that the factor has correlation to abnormal return. The value of Pearson Correlation also shows how two variables relate (positively or negatively correlated). Again, tests for buy signal are separated from those for sell signals.

CHAPTER IV

RESEARCH FINDINGS

Abnormal Returns Obtained by Following RSI Trading Rules

By following the buy signals and sell signals of the 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules, abnormal returns were tested whether they deviated from zero or not. The results are shown below. A-share markets are illustrated first, followed by B-share markets. A summary of research findings about RSI trading rules is shown in Appendix 5.

A-shares

Buy signals

Regarding the buy signals, the results of Shanghai and Shenzhen markets are similar. All buy signals did not work. For Shanghai market, p-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.910, 0.501, 0.326 and 0.511 respectively. As they are all larger than our alpha (0.05), the average abnormal returns therefore do not significantly deviate from zero. The null hypothesis is not

rejected, i.e. there is no evidence showing the trading rules could have positive or negative abnormal returns.

For Shenzhen market, the findings are similar to Shanghai market. P-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.884, 0.565, 0.182 and 0.817 respectively. As they are all larger than alpha, the expected returns do not significantly deviate from zero. The null hypothesis is not rejected, i.e. there is no evidence showing the trading rules could have positive or negative abnormal returns.

Interpretations of buy signals in A-share markets

As we mentioned above, for A-share of both Shanghai and Shenzhen markets, all buy signals did not work. It implies that Chinese investors did not interpret the stock as cheap or worthy to buy, even when the stocks were oversold. Chinese investors just ignored the oversold stocks.

Sell signals

However, the tests on sell signals give us encouraging results. The findings of Shanghai and Shenzhen markets are also similar. All sell signals worked except sell signals of 5-day RSI trading rules.

For Shanghai market, p-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.000, 0.000, 0.000 and 0.000 respectively. They are all

smaller than alpha, the average abnormal returns therefore significantly deviate from zero. The null hypothesis is rejected. T-statistics of 14-day RSI, 12-day RSI and 9-day RSI trading rules are all positive numbers. It shows that the average abnormal returns are significantly greater than zero if these three sell signals are followed. However, t-statistic of 5-day RSI trading rule is –4.814, which is negative. It shows that the average abnormal returns are significantly smaller than zero if this sell signal is used.

For Shenzhen market, p-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.000, 0.000, 0.026 and 0.000 respectively. They are all smaller than alpha. The average abnormal returns significantly deviate from zero and thus the null hypothesis is rejected. Similar to Shanghai market, t-statistics of 14-day RSI, 12- day RSI and 9-day RSI trading rules are all positive. It shows that the average abnormal returns are significantly greater than zero if these three sell signals are followed. However, t-statistic of 5-day RSI trading rule is –6.100, which is negative. It shows that the average abnormal returns are significantly smaller than 0 if this sell signal is followed.

Interpretations of sell signals in A-share markets

For A-share of both Shanghai and Shenzhen markets, we found that the 14-day, 12-day and 9-day RSI sell signals work effectively. It implies that Chinese investors

sold the stocks when the stocks were overbought. To explain why Chinese investors ignored oversold stocks but paid attention to overbought stocks, one of the possibilities is the news effect. When a stock was oversold, its price was relatively low. Financial news always reported stocks that boomed a lot. It therefore drew investors' attentions from poorly performed stocks to well performed stocks. Investors thus paid more attentions to the overbought stock, and the trading volume was naturally higher. Once the stock price looked too expensive, or overbought, investors would then sell to secure profits. The large sell force pushed the price down, with magnitude larger than movement of market index. Therefore investors could earn positive abnormal return by selling upon sell signals.

In this research, we also observed the sell signals worked in both Shanghai A-share market and Shenzhen A-share market.

However, one interesting finding is about the 5-day signals here. If investors had followed the 5-day RSI sell signals to sell, they would have negative abnormal returns significantly because our t-statistics are negative here. Our explanation here is about the strength of index. As "5-day" is a relatively short period, it does not represent a strong enough sell force or buy force. The 5-day signal is therefore not so meaningful here. Trend of rising price or dropping price may or may not end in such a short period. We thus ignore the findings regarding 5-day signals here.

B-shares

We separate B-share markets from A-share markets and the findings are illustrated below.

Buy signals

For B-share markets, the results of using buy signals are different from that of the A-share markets.

For Shanghai B-share market, all buy signals worked. P-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.000, 0.000, 0.000 and 0.000 respectively. The null hypothesis is rejected. T-statistics are all positive. It shows that the average abnormal returns are significantly greater than zero.

For Shenzhen B-share market, all buy signals worked too. P-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.005, 0.011, 0.040 and 0.016 respectively. The null hypothesis is rejected. T-statistics are all positive. It shows that the average abnormal returns are significantly greater than zero.

Interpretations of buy signals in B-share markets

For buy signals in B-share markets, the findings are quite different from A-share markets. All buy signals worked in both Shanghai and Shenzhen B-share markets. It means that Chinese investors usually paid attentions to whether the stocks in

B-share markets were cheap or not. Once they judged the stocks in B-shares markets were oversold, they bought and then pushed up the prices. It turned out the price rise was greater than market performance. They thus obtained positive abnormal returns. However, there must be some reasons of such a difference in behavior between A-share markets and B-share markets. It seemed that investors created more buy force in B-share markets than A-share markets. We will explain this phenomenon after the discussion of sell signals in B-share markets as below.

Sell signals

For sell signals in Shanghai B-share market, p-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are 0.000, 0.000, 0.000 and 0.000 respectively. The hypothesis is rejected. However, t-statistics are all negative. It gives negative average abnormal returns if these four sell signals are followed. Interestingly, the magnitudes of these t-statistics are far greater than those of buy signals and those of the A-share markets. T-statistics of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are –24.667, -25.058, -23.676 and –22.567 respectively, while the same t-statistics of A-share markets are 6.763, 6.855, 5.039 and –4.814 correspondingly.

For sell signals in Shenzhen B-share market, the situation is similar to Shanghai B-share market. P-values of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI

trading rules are 0.000, 0.000, 0.000 and 0.000 respectively. The null hypothesis is rejected. However, t-statistics are all negative too. It gives negative average abnormal returns if these four sell signals are followed. Magnitudes of these t-statistics are also far greater than those of buy signals and those of A-share markets. T-statistics of 14-day RSI, 12-day RSI, 9-day RSI and 5-day RSI trading rules are –26.287, -27.078, -23.782 and –28.433 respectively.

Interpretations of sell signals in B-share markets

Now we look at the sell signals in B-share markets. Interestingly, the sell signals did not work properly, i.e. following sell signals could not generate positive abnormal returns. If investors had followed the sell signals to sell, they would significantly obtain negative abnormal returns. It implies that, when the stock price was overbought according to RSI sell signals, people still bought the stock to push up the price further higher. The buy force was still large even the stocks were already expensive.

We can also describe it in another way. The RSI sell signals in B-share markets were actually effective "buy signals" for investors. If investors bought according to the RSI sell signals in B-share markets, they would obtain positive abnormal returns. Now we can put two pictures together and analyze. Whichever signal it is (buy signal or sell signal), investors still bought the stocks and pushed up the price to

obtain positive abnormal returns.

Some people may explain all these by the booming economy in China. Since investors were optimistic in the economic development of China, they tended to do more buy actions than sell actions. This could be one of the reasons. However, it still could not explain why this phenomenon just happened in B-share markets, but not in A-share markets.

We believe the main reason must be related to the characteristics of B-share markets. One of the possible explanations is "expectation of the merge of A- and B-share markets". In February 19, 2001, China governments started to allow local investors to participate in B-share markets. This not only increased the volume turnover in B-share markets, but also gave investors a signal of the future trend of B-share markets. Investors interpreted the deregulation of B-share markets as the first step of merging B-share markets with A-share markets in foreseeable years. Before the deregulation, B-share prices were far lower than A-share prices. After the deregulation, investors may foresee a rising trend of B-share prices because of the existing big gap between A-share prices and B-share prices. They therefore interpreted the B-shares as cheap. Even the prices rose after they bought them continuously and the RSI passed over 70, investors still thought the prices were too cheap comparing with A-shares. As RSI measures whether the stock is cheap or

expensive only by its past data trend without considering the price gap between B-share and A-share, RSI could not effectively reflect the sell force and buy force of B-shares. This is why investors kept on buying regardless the RSI sell signals.

Not only the inversely works of sell signals give us the above intuition, we can also get some insights from the magnitude of abnormal returns. From Appendix 5, it is found that the absolute values of t-statistics of sell signals in B-share markets are far greater than A-share markets. It means that the abnormal returns of using sell signals to buy in B-share markets are far higher than in A-share markets. The possible reason of that may be the "expectation" effect mentioned above.

In order to further prove the impact of the deregulation of B-share markets started from February 2001, we did an additional research on B-share to investigate.

CHAPTER V

ADDITIONAL RESEARCHES ON B-SHARE MARKETS

The objective of the additional researches on B-share markets is to prove whether the deregulation was the cause of the strange behavior of B-share markets. The research is simple. We just repeated the above research twice, but with different time frames. One was done for the period from 1 Jan 1999 to 31 Jan 2001. Another was done for the period from 1 Feb 2001 to 31 Dec 2001. The two periods represent the period before deregulation announcement and the period after deregulation announcement. (We picked 1 Feb 2001 instead of 19 Feb 2001 because we assumed there was some news leakage several weeks before official announcement.) These researches were conducted on the B-share markets only.

Findings on Additional Researches on B-share Markets

The findings were listed in Appendix 6. When we compare the magnitudes of t-statistics of the period before and the period after February 1, 2001, we can see a big difference. Before February 1, 2001, the t-statistics are around –8 to –15. On or

after February 1, 2001, the t-statistics are around –23 to –33. It shows the impact of the time frame is critical to the magnitudes of t-statistics.

Interpretations of Findings on Additional Researches on B-share Markets

The magnitudes of t-statistics can be interpreted as a measurement of the magnitudes of abnormal returns when the sell signals were used as "buy signals". The difference of t-statistics of the two periods indicates that investors created higher expectation after the deregulation in February 2001. After the announcement of deregulation, investors expected prices of B-shares would rise until they got closed to A-shares. The strong buy force pushed the stock prices up. This buy force was much stronger than before the deregulation. Therefore the abnormal returns after deregulation were higher than before.

This deregulation also explained why the overall abnormal returns of B-shares (using both signals as "buy signals") in the three years are higher than that of A-shares; even the abnormal returns were all generated by our RSI trading rules.

CHAPTER VI

ADDITIONAL RESEARCHES ON A-SHARE MARKETS

Up to this moment, we have studied the workability of the RSI trading rules. Let us have a small conclusion here. For A-share markets, buy signals did not work. Sell signals worked. For B-share markets, buy signals worked. Sell signals worked in the way if investors treated the sell signals as "buy signals". The abnormal returns were higher in B-share markets than in A-share markets if investors knew how to use our RSI trading rules. Higher abnormal returns in B-share markets were due to the deregulation of the B-share markets in February 2001.

However, practitioners usually do not use RSI trading rules alone to make investment decisions. Better performance could be achieved if RSI were used with other indicators or factors. Therefore, we further did tests on two more factors. We would like to find out whether these two factors also have any impacts on the abnormal returns. The two factors we picked were volume turnover and market value.

Correlation between Abnormal Return and Volume Turnover

We picked volume turnover as a factor because we predicted there would be relation between trading volume and abnormal returns obtained under our RSI trading rules. It is because different number of market participants may lead to difference in effectiveness of technical analysis trading rules, including our RSI trading rules. Therefore, we studied the correlation between abnormal returns obtained by our RSI trading rules and volume turnover of the stocks. Our null hypothesis is:

Pearson Correlation = 0.

Findings on Correlation between Abnormal Return and Volume Turnover

The findings on correlation tests are shown in Appendix 7. No correlation exists between abnormal return and volume turnover. All p-values are greater than alpha (0.05). Pearson correlations do not significantly deviate from zero. We do not reject the null hypothesis.

Interpretations of Findings on Correlation between Abnormal Return and Volume Turnover

The finding of zero correlation between abnormal return and volume turnover implies that volume turnover does not have any impact on the abnormal returns

obtained by our RSI trading rules. Volume turnover does not help us to better use the RSI trading rules because volume turnover is an unrelated factor.

Correlation between Abnormal Return and Market Value

Another factor we picked was market value of firm. As we predicted size of firm (market value of firm) could be related to its growth rate expectation. Investors may expect lower growth rates for bigger firms and higher growth rates for smaller firms. In order to investigate whether there was any true relation between abnormal return and market value, we did the test on correlation again, but the two variables are "abnormal return" and market value. Our null hypothesis is:

Pearson Correlation = 0.

Findings on Correlation between Abnormal Return and Market Value

The results are shown in Appendix 8. For buy signals, only the abnormal return obtained by using 9-day RSI buy signal in Shanghai A-share market has correlation with market value with p-value smaller than our alpha (0.05). All other correlations do not deviate from zero.

For sell signals, all the p-values are smaller than alpha. It implies that there is correlation between abnormal return and market value. The correlations

significantly deviate from zero. The null hypothesis is rejected.

Looking at the magnitudes of correlations, it is found that the absolute values of correlations are overall low, which are around 0.14 to 0.24. Correlations are positive in Shanghai market but negative in Shenzhen.

Interpretations of Findings on Correlation between Abnormal Return and Market Value

For the buy signals, although the correlation for 9-day RSI in Shanghai A-share market is larger than zero, we do not draw any conclusion here. It is because the abnormal return obtained by using RSI buy signals in Shanghai A-share market does not significantly deviate from zero. The buy signals have no impact on the abnormal return here. The correlation here is therefore meaningless to our research.

However, for the sell signal side, the results are interesting. We have to look at Shanghai A-share market and Shenzhen A-share market separately because the signs of Pearson correlations of Shanghai A-share market are different from the signs of Pearson correlations of Shenzhen A-share market. For Shanghai, the correlation is positive. For Shenzhen, the correlation is negative. Both are significant, with p-values smaller than alpha.

For Shanghai A-share market, the correlation between abnormal return and

market value is positive. It means that, when the sell signals were followed, the abnormal return would be higher if the market value of firm is higher. We can also say in another way: By following the sell signals to sell, the price of the stock sold would drop more if the firm were bigger.

For Shenzhen A-share market, the correlation between abnormal return and market value is negative. It means that, when the sell signals were followed, the abnormal return would be lower if the market value of firm is higher. We can also say in another way: By following the sell signals to sell, the price of the stock sold would drop less if the firm were bigger.

We cannot explain this strange phenomenon. However, given that the magnitudes of correlations here are small, the correlations are therefore weak. Only very small portion of abnormal return is related to (or can be explained by) market value of firm.

CHAPTER VII

CONCLUSIONS

In conclusion, for A-share markets, RSI buy signals did not work but RSI sell signals worked. For B-share markets, RSI buy signals worked. RSI sell signals worked if investors treated the sell signals as "buy signals". In this sense, RSI is currently a satisfactory trading rule in China market. This research also shows that technical analysis works in China market. The China stock market is not weak form efficient.

The impact of relaxation of trading restriction on RSI trading profits can be proven significant by tests on the abnormal returns for the period before and the period after February 1, 2001. It demonstrates how changes in investing environment can alter RSI trading strategies and results. Current market trend and situation should be carefully considered in applying RSI. For example, in a strong up-trending market, there could be consecutive overbought signals. Short-selling stocks in the first overbought signal may result in tremendous loss. This is exactly the case for B-shares market from February to June, 2001 (Appendix 9).

Volume turnover does not have any relationship with abnormal return. Market value of firm has very small correlation with abnormal return. Anyway, without considering volume turnover and market value or other indicators, our RSI trading rules still beat the market if they are correctly used in China.

CHAPTER VIII

LIMITATIONS

There are several operational issues of RSI that may have significant effect on the validity of the research findings.

First, the testing period is limited to the past three years. The choice of a longer or shorter testing period may render the findings totally different. Moreover, trading rules proved to be workable may or may not also work in the future several years because China's equity markets are emerging markets whose investing environment has been changing rapidly from year to year. The ramifications of government interventions on stock market behavior are particularly critical. An example can be seen in the period immediately after February 19, 2001 when the CSRC announced that domestic investors with legal foreign exchange accounts would be allowed to trade B-shares. This aroused an imminent expectation of a possible merger of A- and B- share markets among markets participants and caused sudden upsurge in B-shares which have long been sold at a discount to the A-shares. As the creditability of technical analysis often rests on the central theme that history repeats itself, this

non-stationarity of investing environment may make technical analysts difficult to search for recognized price patterns and profitable RSI may easily lose its validity. Therefore, strictly following our trading rules to trade in the China market in the coming years may be very dangerous. Users must be careful about the changes in China market environment and use our trading rules together with other judgment tools.

Second, the settings of RSI level more than 70 as overbought signal and RSI level less than 30 as oversold are somewhat arbitrary. Other combinations such as 80-20 may be more appropriate but they have not been tested in our research.

Third, the surging B-shares market started from February 2001 discloses the weakness of applying RSI in probing direction of price movement in a trending market. During that period, continuously losses would have been resulted if sell orders were placed when there were overbought signals. It is because stock prices are more probably to rise (fall) than to fall (rise) in a rising (falling) market trend even there are RSI sell (buy) signals. Therefore RSI should be used only when the market is neither strong bull nor strong bear.

Finally, since RSI signals may prevail with a longer time frame in bearish or bullish market, the compulsory holding period of one day after placing a trading order is unrealistic. Research with other appropriate exit signals or different holding

periods may have different results. Also transaction costs are not taken into account in our research. Whether the abnormal return would be less after considering transaction costs is a question.

CHAPTER IX

FURTHER STUDIES RECOMMENDED

Based on the above operational limitations on RSI, further studies on the following directions may provide more insights on the feasibility of RSI as a trading rule in China market.

This research focuses only on equity market. Similar testing on other markets (e.g. futures, bonds and other derivatives) can also be done, especially to those products whose markets are rather stable like gold. This can help to prove whether RSI is universally applicable in China. In addition, since the merger of A- and B-shares markets are now foreseeable, the investigation as well as comparison of the results from trading on RSI in the following years may give more useful information on how the reduction on trading restriction (i.e. improvement in market efficiency) in investing environment would affect the results of technical trading rules.

Furthermore, the trading rules have taken for granted on some arbitrary inputs like testing period, exit time, overbought and oversold levels of RSI. It is recommended that different values of these inputs can be tested to find out if more

optimal results can be achieved. Different level of transaction costs can also be taken into account, so that the results can be more realistic.

Finally, combined application of RSI with other technical tools like charts or other market data like block trades does not only better the trading result but also more mimic the realistic practice of the technician. This is the reason why we performed the correlation tests in our project as an attempt to dig out those helpful data. Further research on versatile uses of RSI may enhance the trading model.

APPENDIX 1

SOME IMPORTANT GOVERNMENT MEASURES TO EXTEND INVESTOR BASE IN EQUITY MARKETS

Year / Period	Policies taken
Between May 1, 1996 – June 10, 1999	The People's Bank of China (PBOC) has lowered interest earned on bank deposits seven times in an attempt to shift banking saving to investment in stock markets. Rates for 1-year deposit were lowered from 9.16% to 2.25%.
In 1999	20% tax was imposed on bank interest payment as a further effort to move out saving.
	Banks were allowed to take shares as collateral against personal bank loans.
	Joint Sino - foreign securities funds were allowed to invest in B shares.
	Stamp duty charged on B shares stock transactions was lowered from 0.4% to 0.3%.
	Some restrictions on investments in stock markets by mutual funds were lessened to boost institutional investments.
	State-owned legal person shares were tradable so long as the State maintained the largest single interest in any listed state-owned enterprise.
In 2000	CSRS approved the reorganization of the China Futures Association to increase depth and maturity of China's capital market.
	Foreign partners in firms listed on the B share market were allowed to trade their stakes.
	The government did share buy-back for some companies whose stocks had plummeted.
In 2001	Local investors who had legal foreign exchange accounts before February 19, 2001 were allowed to trade in B shares.
In 2002	The PBOC cut deposit rates again by an average of 25 basis points. The rate on ordinary savings account was reduced to 0.72% from 0.99% and the rate for five-year time deposits was cut to 2.79%. The benchmark one-year fixed deposit rate was reduced by 27 basis points to 1.98%.

Source: Economist Intelligence Unit. China hand: investing, licensing, and trading conditions in the People's Republic of China. London: Economist Intelligence Unit, March 2002.

APPENDIX 2

COMPOSITION OF INVESTOR ACCOUNTS AT THE YEAR-END 1999 (UNIT: MILLION)

	Shanghai Stock Exchange	Shenzhen Stock Exchange	Total	Percentage of the total
Institutional accounts	8.32	11.47	19.79	0.4416%
Individual accounts	2,272.80	2,189.38	4,462.18	99.5584%
Total	2,281.12	2,200.85	4,481.97	100%

Source: 康榮寶. 深入中國股市. 台灣：天下文化書坊, 2001, p. 40..

APPENDIX 3

CATEGORIZATION OF PRINCIPAL SHARE TYPES (UNIT MILLION)

	1998	1999	2000
Shares as yet untraded			
1. Promoter shares, including:	1,429.33	1,747.09	2,165.40
i. State owned shares	865.51	1,116.07	1,475.13
ii.Domestic legal person shares	528.06	590.51	642.55
iii.Foreign capital legal person shares	35.77	40.51	46.20
iv.Others	0	0	1.53
2. Social legal person shares	152.34	190.10	214.21
3. Internal Staff shares	51.70	36.71	24.29
4. Others	31.47	33.20	24.65
Total non-tradable	1,664.84	2,007.19	2,437.43
% of the total	66%	65%	64%
Shares already traded:			
1.Domestically listed RMB common shares	608.03	813.18	1,078.17
2. Domestically listed foreign capital shares	133.96	141.92	151.57
3. Overseas listed foreign capital shares	119.95	124.54	124.54
Total tradable	861.94	1079.64	1,354.28
% of the total	34%	35%	36%
Total	2,526.79	3,086.74	3,791.70

Source: 康榮寶. 深入中國股市. 台灣：天下文化書坊, 2001, p.29.

APPENDIX 4

DOMESTIC STOCK EXCHANGES: AGGREGATE LISTINGS AT THE END OF 2001

	Shenzhen	Shanghai
A-share listings	504	636
B-share listings	55	54

Source: Datastream.

APPENDIX 5

TEST OF ABNORMAL RETURNS OBTAINED BY THE TRADING RULES FOR BUY AND SELL SIGNALS IN THE PAST 3-YEAR PERIOD

Null hypothesis: $\mu = 0$
Alternative hypothesis: $\mu \neq 0$

Shanghai A-share **buy** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	0.910	0.501	0.326	0.511
t-statistic	0.114	-0.673	-0.982	0.658
mean	2.024E-05	-1.119E-04	-1.553E-04	9.020E-05

Shenzhen A-share **buy** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	0.884	0.565	0.182	0.817
t-statistic	0.146	-0.576	-1.336	-0.232
mean	2.058E-05	-7.183E-05	-1.364E-04	-1.746E-05

Shanghai A-share **sell** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	**0.000**	**0.000**	**0.000**	**0.000**
t-statistic	6.763	6.855	5.039	-4.814
mean	2.263E-03	2.013E-03	1.140E-03	-6.777E-04

Shenzhen A-share **sell** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	**0.000**	**0.000**	**0.026**	**0.000**
t-statistic	4.141	4.128	2.227	-6.100
mean	1.761E-03	1.532E-03	6.139E-04	-9.989E-04

Shanghai B-share **buy** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	**0.000**	**0.000**	**0.000**	**0.000**
t-statistic	8.756	9.636	12.345	13.243
mean	8.410E-03	7.184E-03	6.396E-03	5.709E-03

Shenzhen B-share **buy** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	**0.005**	**0.011**	**0.040**	**0.016**
t-statistic	2.915	2.617	2.108	2.496
mean	2.471E-03	1.938E-03	1.205E-03	1.230E-03

Shanghai B-share **sell** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	**0.000**	**0.000**	**0.000**	**0.000**
t-statistic	-24.667	-25.058	-23.676	-22.567
mean	-1.499E-02	-1.499E-02	-1.474E-02	-1.135E-02

Shenzhen B-share **sell** signal:

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	**0.000**	**0.000**	**0.000**	**0.000**
t-statistic	-26.287	-27.078	-23.782	-28.433
mean	-2.769E-02	-2.667E-02	-2.335E-02	-1.775E-02

APPENDIX 6

COMPARISON OF THE TEST RESULTS OF ABNORMAL RETURNS OBTAINED BY THE TRADING RULES BEFORE AND AFTER 1 FEBRUARY 2001

BEFORE 1 February 2001

Shanghai B-share sell signal

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	0.000	0.000	0.000	0.000
t-statistic	**-8.185**	**-10.247**	**-11.606**	**-13.651**
mean	-9.335E-03	-9.853E-03	-1.026E-02	-8.015E-03

Shenzhen B-share sell signal

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	0.000	0.000	0.000	0.000
t-statistic	**-13.261**	**-13.868**	**-12.891**	**-15.463**
mean	-1.567E-02	-1.504E-02	-1.294E-02	-1.100E-02

ON or AFTER 1 February 2001

Shanghai B-share sell signal

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	0.000	0.000	0.000	0.000
t-statistic	**-25.635**	**-27.602**	**-33.081**	**-27.560**
mean	-1.900E-02	-1.945E-02	-2.118E-02	-1.757E-02

Shenzhen B-share sell signal

	14-day RSI	12-day RSI	9-day RSI	5-day RSI
p-value	0.000	0.000	0.000	0.000
t-statistic	**-23.494**	**-25.355**	**-25.575**	**-27.462**
mean	-4.358E-02	-4.291E-02	-4.279E-02	-3.260E-02

APPENDIX 7

TESTS OF CORRLATIONS BETWEEN "VOLUME TURNOVERS" AND "ABNORMAL RETURNS" OBTAINED BY THE TRADING RULES

Null hypothesis: **Pearson Correlation = 0**
Alternative hypothesis: **Pearson Correlation $\neq$ 0**

Shanghai A-share market:

	Pearson Correlation	**p-value**
Following 14-day RSI trading rule buy signals	0.037	0.572
Following 12-day RSI trading rule buy signals	0.061	0.352
Following 9-day RSI trading rule buy signals	0.055	0.403
Following 5-day RSI trading rule buy signals	0.058	0.374
Following 14-day RSI trading rule sell signals	-0.015	0.822
Following 12-day RSI trading rule sell signals	-0.022	0.733
Following 9-day RSI trading rule sell signals	-0.015	0.816
Following 5-day RSI trading rule sell signals	0.016	0.801

Shenzhen A-share market:

	Pearson Correlation	**p-value**
Following 14-day RSI trading rule buy signals	-0.013	0.778
Following 12-day RSI trading rule buy signals	-0.030	0.505
Following 9-day RSI trading rule buy signals	-0.031	0.502
Following 5-day RSI trading rule buy signals	-0.039	0.399
Following 14-day RSI trading rule sell signals	-0.014	0.758
Following 12-day RSI trading rule sell signals	-0.019	0.682
Following 9-day RSI trading rule sell signals	0.011	0.816
Following 5-day RSI trading rule sell signals	-0.023	0.608

APPENDIX 8

TESTS OF CORRLATIONS BETWEEN "MARKET VALUES" AND "ABNORMAL RETURNS" OBTAINED BY THE TRADING RULES

Null hypothesis: **Pearson Correlation = 0**
Alternative hypothesis: **Pearson Correlation ≠ 0**

Shanghai A-share market:

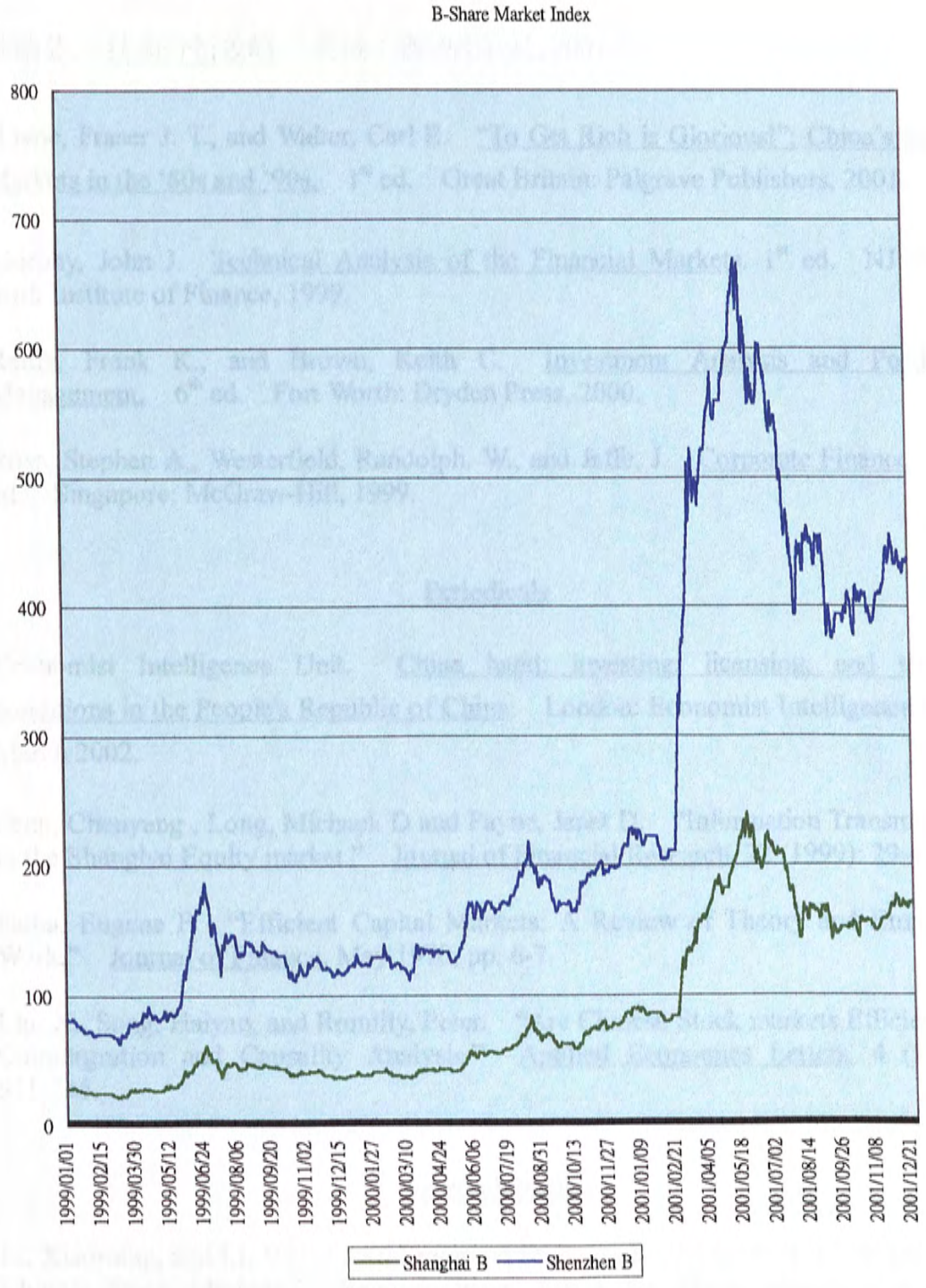
	Pearson Correlation	**p-value**
Following 14-day RSI trading rule buy signals	0.004	0.952
Following 12-day RSI trading rule buy signals	0.031	0.639
Following 9-day RSI trading rule buy signals	**0.253**	**0.000**
Following 5-day RSI trading rule buy signals	0.122	0.061
Following 14-day RSI trading rule sell signals	**0.156**	**0.017**
Following 12-day RSI trading rule sell signals	**0.238**	**0.000**
Following 9-day RSI trading rule sell signals	**0.162**	**0.013**
Following 5-day RSI trading rule sell signals	**0.144**	**0.027**

Shenzhen A-share market:

	Pearson Correlation	**p-value**
Following 14-day RSI trading rule buy signals	-0.025	0.578
Following 12-day RSI trading rule buy signals	-0.036	0.428
Following 9-day RSI trading rule buy signals	-0.056	0.224
Following 5-day RSI trading rule buy signals	-0.081	0.077
Following 14-day RSI trading rule sell signals	**-0.172**	**0.000**
Following 12-day RSI trading rule sell signals	**-0.172**	**0.000**
Following 9-day RSI trading rule sell signals	**-0.152**	**0.001**
Following 5-day RSI trading rule sell signals	**-0.182**	**0.000**

APPENDIX 9

B-SHARE MARKET INDICES



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